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Examining consumer behaviour toward genetically modified (GM) food in Britain

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Abstract

This study examined behaviour towards genetically modified (GM) food in a British community-based sample. We used an equivalent gain task in which participants actually received the options they chose to encourage truthful responding. In conjunction with this, theory of planned behaviour (TPB) components were evaluated so as to examine the relative importance of behavioural influences in this domain. Here the TPB was extended to include additional components to measure self-identity, moral norms and emotional involvement. Results indicated that the monetary amounts participants accepted in preference to GM food were significantly lower than those accepted in preference to non-GM food. However, the vast majority of participants were indifferent between GM and non-GM food options. All TPB components significantly predicted behavioural intentions to try GM food, with attitudes towards GM being the strongest predictor. Self-identity and emotional involvement were also found to be significant predictors of behavioural intentions but moral norms were not. In addition, behavioural intentions significantly predicted behaviour, however, PBC did not. An additional measure of participants' propensity to respond in a socially desirable manner indicated that our results were not influenced by self presentation issues giving confidence to our findings. Overall, it appears that the majority of participants (74.5%) would purchase GM food at some price.

Keywords: GM foods; Behaviour; Intentions; Theory of Planned Behaviour; Contingent valuation task

1. INTRODUCTION

An understanding of the perceptions of, and likely reactions towards, genetically modified (GM) foods is crucial for decision making by both policy makers and biotechnology companies. This is of particular current importance within Europe. The self-imposed moratorium on importing GM food within Europe was lifted in April 2004 alongside new labelling laws¹ meaning it is now, therefore, legal to import GM food into Europe. Although there has been little exploitation of this so far, it is likely that the quantity of GM food available in Europe will increase in the near future.

Various surveys have examined attitudes towards genetically modified (GM) foods in Europe, the most notable of these being the Eurobarometer series of publications (e.g. Gaskell, Allum and Stares, 2003). The most recent Eurobarometer study indicated that the majority of European countries do not support GM food although there is considerable variation between countries. Spain, Portugal, Ireland and Finland demonstrated weak support for GM food (Gaskell et. al., 2003) whilst other countries examined were negative or ambivalent (Gaskell et. al., 2003). The British population was found to be quite ambivalent towards GM food overall (Gaskell et. al., 2003; Poortinga and Pidgeon, 2004). People within Europe have been found to be significantly more negative towards GM food than people within the U.S. (Gaskell, Bauer, Durant, and Allum, 2003; Moon and Balasubramanian, 2003) and these differences may be due to a higher number of food scares that have occurred within Europe and a lower trust of governing institutions displayed by Europeans (Anderson and Jackson, 2003).

1.1. The Theory of Planned Behaviour (TPB)

Although attitudes and behaviour are strongly related, they are not directly correspondent. A variety of influences impact upon behaviour and these must be considered when making predictions regarding behavioural reactions to the introduction of GM foods. The theory of planned behaviour (TPB: Ajzen, 1988) is one of the most useful, and widely used, conceptual frameworks used to link attitudes and behaviour. This model proposes that subjective norms (defined as perceived social pressure from those individuals whose opinion is important to the individual in question), attitudes and perceived behavioural control (PBC) together determine intentions. Such intentions, along with PBC, are thought to determine behaviour (see Figure 1). By applying this model to a particular behaviour, the total amount of variance in behaviour explained by these factors can be examined, as well as the relative influence of these factors. This then facilitates the prediction of behaviour and aids interventions by helping to pinpoint the most influential behavioural antecedents.

Insert Fig. 1 about here

1.2. Components added to the TPB

The TPB is amenable to the inclusion of additional components in order to better predict variance in behavioural intentions and/or actual behaviour (Ajzen, 1991) and a variety of cognitive factors have been examined alongside the TPB model with this aim. Self-identity is a concept that has frequently been added to TPB models as an additional predictor of intentions and behaviour. It has been described as the part of an individual's self that is salient in the context of the behaviour in question (Conner and McMillan, 1999) and is suggested to encompass both personal and social identity

(Sparks and Guthrie, 1998). Moral norms have also frequently been included as an additional predictor in the TPB. Moral norms are defined as personal norms regarding what is right and what is wrong (Bredahl, Grunert and Frewer, 1998). The inclusion of self identity and moral norms within the TPB has so far met with mixed success (Terry, Hogg and White, 1999; Sparks, Shepherd and Frewer, 1995; Sparks and Shepherd, 2002).

The TPB, along with other socio-cognitive models of behaviour, has been criticised for its failure to include affective influences (Conner and Armitage, 1998). Consequently, several researchers have added affective components e.g. anticipated affect (Simonson, 1992; O'Connor and Armitage, 2003) to the TPB model in order to explain further variance in behavioural intentions. The slightly different affective construct of emotional involvement may also be useful within the TPB model. Emotional involvement is defined as the extent to which the individual is engaged with (or disinterested in) the behaviour at hand. Level of engagement has previously been examined as a factor relating to support of biotechnologies (Gaskell, et al., 2003) and it was found that individuals who are more engaged with biotechnologies are more supportive of biotechnologies. In addition, the generalisability of past survey research, examining attitudes towards GM food, is criticised due to potential biases in the samples recruited, which are largely composed of individuals who are already particularly emotionally engaged with the issue of GM (e.g. Gaskell, 2004; Campbell and Townsend, 2003; Townsend and Campbell, 2004). This again suggests that emotional involvement is an important factor relating to support of GM food. So far, however, emotional involvement has not been investigated in previous incarnations of the TPB model. Overall, it seems that the predictive validity of the TPB may be increased through the addition of further relevant cognitive and affective factors.

1.3. The TPB and GM food

The TPB has frequently been applied to health behaviours and eating behaviours and has also been used to investigate behavioural intentions regarding GM food several times within Italy, New Zealand and Britain. Saba and Vasallo (2002) conducted a study in Italy that examined intentions to try the specific product of GM tomatoes and Cook, Kerr and Moore (2002) conducted a study in New Zealand that examined intentions to try GM food generally. Regarding the British studies, Sparks, et al., (1995) examined expectations, rather than intentions, with regard to GM foods (presumably it was considered that this made more sense at the time due to the relatively novel nature of the food) and Sparks and Shepherd (2002) examined individuals intentions to purchase certain specific GM food stuffs (genetically engineered pork and tomatoes) if they become available in Britain.

Within the original TPB constructs, attitudes have been consistently significant in predicting intentions towards GM food whilst evidence with regards to PBC and subjective norms is varied (Cook, et al., 2002; Saba and Vasallo, 2002; Sparks, et al., 1995; Sparks and Shepherd, 2002). All studies found that PBC was an important factor in at least one of the intention measures examined whilst evidence regarding subjective norms is less substantial with only the Italian study (Saba and Vasallo, 2002) and the New Zealand study (Cook, et al., 2002) finding subjective norms to be an influential factor.

These studies have variously added the components of moral norms and self identity to the TPB, to the aim of better predicting intentions towards GM food, with mixed success. Moral norms were found to be non-significant in all studies in which it was included except for the British study which examined intentions to eat specific GM foodstuffs (Sparks and Shepherd, 2002). The construct of self-identity is more

promising though and was a significant predictor of intentions to purchase GM food in New Zealand although it only predicted certain expectations with regards to GM food in Britain (Sparks, et al., 1995).

The importance of the constructs of PBC, subjective norms, moral norms and self identity with regard to behaviour towards GM food is likely to be dependant on the specific definition of intention employed and the particular sample of participants that are recruited. Amount of variance accounted for in behaviour towards GM food was fairly high in all studies varying from around 41% (Saba and Vasallo, 2002) to around 88% (Sparks, et al., 1995) indicating that the TPB is a useful model with which to predict, and analyse, behavioural intentions towards GM food.

1.4. Behaviour towards GM food

To date, TPB studies of GM food have not included any measures of actual behaviour with regard to GM food. This is probably due to practical reasons in that GM food is not currently widely available in Britain. However, behaviour in response to GM food has been examined in other (non-TPB) studies.

One way of examining behaviour towards GM food is through the use of contingent valuation techniques. Contingent valuation techniques are ways of discovering the value of a good by asking people how much they would be willing to pay, or accept, for that good (see Venkatachalam, 2004 for a review). An interesting study conducted by Noussair, Robin and Ruffieux (2004) investigated willingness to pay information for GM foods in a representative sample of French consumers. Overall, 65% of participants in this study were willing to accept GM food at some price. The results of this study contrast quite starkly with other surveys that indicated that people in France were predominantly negative towards GM foods (Gaskell et al., 2000;

Noussair, Robin and Ruffieux, 2001). Noussair et al., (2004) suggest this disparity may have arisen from differences in what was measured; whereas surveys elicit responses from participants as citizens, who are likely to make judgements from the point of view of society as a whole, purchase decisions elicit responses from participants as private consumers.

A similar contingent valuation technique was employed by Moon and Balasubramanian (2003) in investigating consumer behaviour in the UK. Results indicated that 13.3% of consumers were likely to accept GM technology whether there was a price reduction or not and 13.8% of consumers were price conscious and would buy GM food if this was cheaper than other types of food. These responses were made in relation to a question regarding willingness to pay a premium for non-GM foods though and it is noted that responses may differ if the question was worded differently, for example, if the situation was described in regards of GM foods being cheaper than non-GM foods.

In addition, the fact that these contingent valuation studies utilised questions that addressed participants' willingness to pay can be criticised as possibly underestimating valuations. There is a well documented disparity between willingness to pay estimates and willingness to accept estimates (Mitchell and Carson, 1989; Shogren et al., 1994) the former producing estimates that are generally lower than the latter form of estimates. Differences may have arisen because of loss aversion differences² and if loss aversion is treated as a bias then an equivalent gain task may be a more appropriate valuation technique (Bateman et al., 1997). Equivalent gain methods treat both the money and the good symmetrically as gains, effectively removing the influence of loss aversion effects. It is acknowledged, however, that willingness to pay information may be considered as an ecologically valid method of eliciting valuations.

Another problem associated with studies investigating behaviour using stated preferences is the often hypothetical nature of the questions employed; this type of responding is susceptible to influence from social desirability effects and demand characteristics. In circumstances when behaviour cannot be directly observed, it is beneficial to place participants in a more realistic consumer role in which the choices they make have tangible, real life outcomes. This should encourage more honest and realistic responding.

Behaviour towards GM food has also been examined within experimental situations in which participants are simply offered a GM food sample. Within the UK, Townsend and Campbell (2004) conducted an experiment which required participants to compare the taste and appearance of apples that were purportedly grown either organically, traditionally, or using GM technology. In reality the apples used were identical and the real purpose of the experiment was to examine how many participants would be willing to taste the (purportedly) GM apple. A vast majority of 93% participants agreed to try the apple even though it was emphasised that they were not obliged to and the experiment could proceed without them doing so. These results differ quite dramatically from survey results that indicate that British consumers are ambivalent towards GM food (Gaskell et al., 2003; Poortinga and Pidgeon, 2004).

Similar results were found within a study that offered participants GM cheese conducted in Denmark, Finland, Norway and Sweden (Lahteenmaki, et al., 2002). An overwhelming majority of participants within this study agreed to try the GM cheese and around two-thirds of participants chose to take some home. Again results contrasted with explicit attitudes which were examined within the same study that indicated that participants were negative towards GM food.

Overall, evidence with regards to behaviour towards GM food in Britain is mixed. Experimental studies with real life outcomes indicated that participants are likely to try GM food (Townsend and Campbell, 2004) whilst contingent valuation methods indicated that only a small percentage of participants would accept GM food (Moon and Balasubramanian, 2003). Differences between studies are likely to be due to a variety of differences in the methodologies used. For example, the contingent valuation study was hypothetical whereas the experimental study was not, and the contingent valuation task utilised a monetary perspective whereas the experimental study did not.

Behaviour towards GM food has repeatedly been found to be more positive than explicit attitudes have indicated, both in Britain and abroad. Differences in findings may be at least partly because as Noussair et al., (2004) suggest, methods used to examine attitudes and behaviour put participants in different roles; participants may respond to surveys as public citizens but respond to valuation tasks as private consumers. It seems likely, however, that other factors influence behaviour alongside attitudes and factors included within the TPB, such as subjective norms and PBC, may help to explain the differences noted between attitudes and behaviour.

1.5. Study aims

The aim of the current study was to apply a modified TPB model to a British sample, where an actual behavioural measure was included within the study in order to gain a more comprehensive and realistic idea of behaviour with regard to GM food, and the relative importance of behavioural influences in this domain. Behaviour was measured using an equivalent gain task and in order to increase the accuracy of results

provided by participants they were told they would receive the outcome of their choice as an incentive to provide truthful responses.

The TPB model that was applied here was an extended version of the original that included the constructs of self-identity, perceived moral obligation and emotional involvement as additional predictors in order to examine their potential worth in this domain (see Figure 1). Data collected for the TPB variables was hypothesised to provide a good fit to the theorised model. In addition, the group of participants were expected to be ambivalent towards GM foods overall and for this reason mean levels of attitudes, self identity and intention were anticipated to be neutral. PBC was hypothesised to be positive as previous research indicated that GM food was considered a relatively controllable issue (Townsend, Clarke and Travis, 2004). We predicted that subjective norms and moral norms were likely to be significantly negative towards GM food because it is thought that previous negative evaluations of GM food may have been, at least partly, due to societal considerations (Noussair et al., 2004). Levels of emotional involvement were predicted to be neutral as participants were not likely to have any links, or engagement, with the issue of GM foods. With regards to behaviour, we predicted that non-GM chocolates would be preferred to GM chocolates, as GM food is generally perceived more negatively than ordinary food (Noussair, et al., 2001; Moon and Balasubramaniam, 2003). However, on the basis of past studies, we also predicted that most people would accept GM food at some price (Noussair et al., 2004)

2. METHOD

2.1. Design

This experiment had a within subjects design. TPB variables were examined using direct questions with the exception of the behavioural measure, which was

examined using, a) an equivalent gain task, b) the number of participants willing to accept GM at some price.

2.2. Participants

In total 99 participants took part in this study, recruited from two different call centres within the city of Nottingham in England. The population in this area encompasses a variety of ethnicities and is thought to represent a good cross-section of the British population. Employees at the call centres utilised were of a varying level of education, some were school leavers whilst others had undertaken some further education; all were employed full time. Participants were recruited topic blind in order to avoid sampling biases in favour of those individuals who are particularly interested in GM food issues (Campbell and Townsend, 2003; Townsend and Campbell, 2004; Townsend et al., 2004). In total 63 males and 36 females took part in the study and ages ranged from 17 to 55 with a mean of 25.04 (standard deviation = 7.24).

2.3. Materials

The materials used consisted of a questionnaire that included three sections. The first section consisted of an equivalent gain behavioural lottery task (Bateman, et al., 1997). This consisted of two pages of options that asked participants to choose between a series of options consisting of a monetary amount and a box of chocolates e.g. 'We give you £0.60 or we give you a box of 8 chocolates'. One page offered a box of 8 GM chocolates as an alternative to the monetary options and one page offered a box of 8 non-GM chocolates as an alternative; which version was presented first was counterbalanced between participants. Twenty options were provided on each page and these increased in increments of £0.30 starting from £0.00 and finishing at £5.70. As an

incentive to be truthful in their choices, it was emphasised to participants that they would actually receive one of these options, drawn from one of the lotteries. A random number generator (Haahr, 2000) was used in order to pick which option each person actually received. These were all drawn from the page that gave non-GM chocolates as an alternative, due to the difficulty of actually obtaining GM chocolate in this country. Chocolates provided were a box of eight 'Classic' chocolates bought from Thorntons Plc. at a cost of £3.00 a box.

The second section consisted of a series of questions examining TPB variables as well as the additional postulated factors included; see Appendix for full details of questions used. Questions were constructed by examining guidelines for assessing the TPB provided by Ajzen (2002) and by examining previous applications of the TPB to food and GM food. Questions were formulated to directly (rather than indirectly using underlying beliefs) assess factors; these questions were then piloted to examine the consistencies of responses and only those that produced consistent responses, with Cronbach's alphas of 0.7 or higher, were included in the final questionnaire.

Intention was assessed using two questions that examined individuals' intention to try GM food, e.g. 'When eating, I intend to make sure that my food does not contain GM ingredients'. Responses were measured on seven-point, semantic differential scales with appropriate adjectives at each end; in this case 'True' and 'False' were used. Attitude was measured in the manner suggested by Ajzen (2002). This consisted of a question, 'In general I believe that the use of gene technology in food production is:' that had to be responded to six different semantic differential scales marked with a selection of adjective pairs. Adjectives were selected using a pre-test from a much larger selection drawn from the list of published adjective scales that were found to load highly on the evaluative factor of attitudes (Osgood, Suci and Tannenbaum, 1957). The

assessment of subjective norms used three direct questions that were considered to evaluate perceptions of what close friends and family feel about GM food, e.g. 'The people in my life who are important to me would not mind if I ate GM food' (Agree-Disagree). PBC was evaluated using three questions designed to evaluate participants perceived difficulty with and control over their choice regarding whether to eat GM foods or not, e.g. 'How much control do you feel you have over eating a GM free diet?' (Complete control – No control).

The component of self-identity was assessed using questions that examined the respondent's self-belief about whether they were the kind of person that would eat GM food. This was done using two questions, e.g. 'I am the type of person that would eat GM food' (True - False). Moral norms were assessed using three questions that evaluated how respondents felt morally about GM foods, e.g. 'I do not consider the production of GM foods morally wrong' (Agree - Disagree). The additional component of emotional involvement was assessed using four questions, e.g. 'How emotional do you feel about the decisions taken to produce GM food?' (Emotional - Not very emotional). These were designed to examine to what degree the respondent was engaged with the issue at hand.

In order to assess social desirability in participants' responses on the TPB a third section was also included and this contained a shortened version of the Marlowe-Crowne social desirability scale (Strahan and Gerbasi, 1972) headed with the title 'Personal beliefs'. This version was included rather than the full version in order to take less time to complete and because this version was found to be of a similar internal consistency to the original measure. To our knowledge, no previous study has examined the extent to which participants present themselves in a socially desirable manner when responding to questionnaires within this domain.

2.4. Procedure

An individual at each call centre was recruited in order to provide questionnaires to their colleagues. All call centre staff were asked to participate apart from managerial staff and the majority agreed to fill in questionnaires. For recruitment purposes individuals were simply asked if they would fill in a questionnaire and the topic of GM food was not revealed. None of those who initially agreed to take part withdrew after starting the questionnaire and encountering the topic of GM food. The order of the questionnaire presented questions assessing TPB components first, followed by the equivalent gain task; this presentation order was consistent across participants. The equivalent gain task did not present any details about the GM chocolate utilised within the task. If questioned on the chocolates, the experimenter told participants that GM chocolates were samples obtained from a biotechnology company and that these were currently available in the U.S. Participants provided their name and contact details at the end of the questionnaire and it was made clear that this was to provide them with their lottery prize only and that their actual responses would be associated only with a randomly assigned participant number. A random number was generated for each participant and this determined which option their prize was drawn from. Participants received the choice they had made for that numbered option. Prizes, consisting of either money or chocolates, were provided to the contact within each call centre to pass on to his relevant colleagues and signatures were obtained to make sure that this was done. Upon receiving their prizes, participants were informed that all chocolates provided as prizes were non-GM and that the offer of GM chocolates was actually a deception in order to provoke honest responses. Participants were also told that GM chocolates are not currently available in the U.K. Prizes were distributed after all data collection was

completed to ensure that the deception involved in the experiment was not revealed to participants prior to completing the questionnaire.

3. RESULTS

3.1. Equivalent gain task

The critical value within the equivalent gain task was the lowest amount of money that a participant would accept instead of a box of chocolates. This was used as an indication of the valuation of that box of chocolates. The amounts of money participants were willing to accept in preference to a box of GM chocolates were positively skewed with a median of £1.20 and ranged up to the maximum possible valuation of £5.70. With regard to monetary amounts participants were willing to accept in preference to a box of non-GM chocolates, again a positive skew was evident and the median amount was £2.10 with a range of £5.70. The actual difference between the monetary amounts accepted in preference to GM and non-GM chocolates was, therefore, £0.90 (£2.10-£1.20). A Wilcoxon Signed Ranks test showed that the monetary amounts accepted in preference to GM chocolates were significantly lower than the monetary amounts accepted in preference to non-GM chocolates ($z = -5.096$, $p < 0.001$).

In order to remove the influence of inter-individual variation in preference for chocolates generally, the behavioural measure was calculated as the amount of money the participant preferred over a box of GM chocolates minus the amount of money the participant preferred over a box of non-GM chocolates. This measure was again very positively skewed and very kurtotic with an almost unimodal distribution at zero; the median of this measure was zero. One outlier, which was over three standard deviations away from the mean, was present in the data and this was removed.

Overall 43.4% (43/99) people would accept less money instead of GM chocolates as compared to non-GM chocolates. 48.5% (48/99) people would accept the same amount of money instead of GM and non-GM chocolates and 8.1% (8/99) people would accept more money instead of GM chocolates than instead of non-GM chocolates, see Figure 2. In addition, of those who would accept either kind of chocolates at all (94.9%), 74.5% people (70/94) would prefer GM chocolates over money at some level and only 25.5% (24/94) would not. In other words, most people accepted GM chocolates at some price.

Insert Fig. 2 about here

3.2. Attitudes and Intentions

Questions examining TPB components were reverse scored as necessary so that on the scale from one to seven, the middle point indicating neutrality was four, with one indicating a negative stance towards GM foods, and seven indicating a positive stance towards GM foods. With regards to emotion, one indicated a low amount and seven indicated a high amount of emotional involvement felt and with regards to PBC, one indicated a low amount and seven, a high amount of perceived control.

Internal consistencies for each component were examined using Cronbach's alpha. All measures displayed reasonable to good levels of internal consistency, except for intention, which displayed a lower internal consistency level of 0.51 indicating that the interpretation of this factor should be treated with some degree of caution.

Means and standard deviations are shown in Table 1. In order to test the significance of the levels of each factor examined, several one way t-tests were used. Subjective norms and moral norms were significantly positive. Levels of emotional

involvement were quite negative with a mean of 3.28 and mean levels of intention were 4.39 which is marginally significant ($t(98) = 2.67, p = 0.009$). No other differences approached significance. Correlations between TPB variables are displayed in Table 2.

Insert Table 1 about here

Insert Table 2 about here

3.3. Predicting intention from TPB variables

As non-normal distributions were evident within variables, these were standardised before further analysis. A linear regression with a forced method of entry of variables indicated that TPB variables predicted around 51% of variance in intentions which was a significant amount of variance accounted for (see Table 3). When the TPB was modified to include self-identity, emotional involvement and moral norms around 66% of variance in intentions was accounted for by the model (a significant increase). In the original TPB model, attitude was found to be the strongest predictor of intentions, followed by subjective norms and PBC, however, in the extended TPB model, self-identity became the strongest predictor of intentions, followed by attitude, emotional involvement and PBC. Moral norms were not found to be a significant predictor of intentions. Subjective norms became non-significant when the additional components were added indicating that some collinearity may exist between the construct of subjective norms and the components added to the original TPB model. VIF (Variance Inflation Factor) levels were examined to check for multicollinearity and although these were fairly high, they were of an acceptable level.

Insert Table 3 about here

In a second linear regression we regressed intentions and PBC on behaviour with a forced entry method. This showed that intention was found to significantly predict behaviour, when behaviour was measured as the difference between amounts of money accepted instead of GM food and instead of non-GM food, see Table 4. PBC, however, did not predict behaviour significantly. The regression analysis revealed that 17.7% of variance in behaviour, a small but significant proportion, was predicted by intention and PBC together.

We also examined whether TPB variables could predict willingness to accept GM. To this end, whether or not people would accept GM chocolates over some amount of money or not was also used as a dichotomous measure of behaviour. A logistic regression, with a forced entry method, was employed to examine how well the TPB model could predict behaviour measured in this way, see Table 5. Again, intention was a significant predictor of this measure of behaviour, whereas, PBC was not. The model was able to correctly classify 74.7% of cases and a chi-square test indicated that the model significantly improved predictive power. McFaddens pseudo R^2 was also calculated and this was found to be 0.137, indicating that the inclusion of intention and PBC as predictor variables improves the model.

Insert Table 4 about here

Insert Table 5 about here

3.4. Self presentation

Self-presentation levels, as measured by a shortened version of the Marlowe-Crowne, were found to be fairly high with a mean of 9.67 (standard deviation = 3.54). We carried out correlation analyses to determine whether there was a relationship between the levels of self-presentation and responses on TPB variables. No significant relationships were uncovered in this analysis.

4. DISCUSSION

The proposed TPB model fitted data well and predicted a significant proportion of intentions and a small, but significant, proportion of behaviour as measured by an equivalent gain task. This study indicates that behaviour towards GM food may be more positive than previously thought and highlights the factors that are most important in influencing this behaviour.

4.1. Acceptance of GM food

Results indicated that participants preferred non-GM chocolates to GM chocolates and this supports findings from previous research (Moon and Balasubramanian, 2003). Despite this, this majority of participants were indifferent between GM and non-GM alternatives. In fact a small amount of people preferred the GM alternative offered, which may be due to a general curiosity in trying GM chocolates (which are not yet available in Britain) and a propensity towards risk seeking behaviour (Bromiley and Curley, 1992). Interestingly, of those people willing to accept either type of chocolates in preference to money, around three-quarters of participants would accept GM food at some price. These results indicate that more people than previously thought are likely to accept GM food if it becomes more widely available

within Britain. This finding supports results that showed that a majority of British participants were willing to try GM food when offered (Townsend and Campbell, 2004). Likely behaviour towards GM food was found to be much more positive than explicit attitudes and this is in keeping with results found by Noussair et al., (2004) in France. As Noussair et al., (2004) suggest, it is likely that participants respond to surveys as a citizen, bearing in mind social interests but when responding to a more ecologically valid shopping task, respond as a consumer with a greater emphasis on private interests. In fact as demonstrated within this study, a variety of other factors impact on behaviour alongside attitudes.

Results are more positive than that found by the study by Moon and Balasubramanian (2003) which investigated behaviour towards GM using contingent valuation methods within Britain. This disparity between may have arisen because we used an equivalent gain method which is likely to differ from previous contingent valuation tasks that have employed willingness to pay methods because of the loss aversion to money effects inherent in willingness to pay methods. In addition, differences between the behavioural task used here and the task employed by Moon and Balasubramanian (2003) may have arisen due to the enhanced reality of the situation provided by our task, which was likely to have elicited more authentic responses than the hypothetical questions utilised in previous tasks. (Here we told participants that we would provide them with a prize selected at random from one of their preferences made within the equivalent gain task.)

It could be argued that social desirability effects and demand characteristics may still have influenced responding in this task, however, assuring participants of anonymity and providing real consequences to options made are likely to have greatly reduced these influences. We also found that participants' responses on the shortened

version of the Marlow-Crowne social desirability scale did not correlate with responses given. For these reasons, the responses provided in this task are likely to provide a more accurate idea of valuations of GM foods than previous tasks.

4.2. The Theory of Planned Behaviour

Our results showed that the standard TPB model accounts for around 51% of variance in intentions and all our hypothesised predictors (attitudes, subjective norms and PBC) accounted for significant proportions of variance. The importance of attitudes supports previous research, however the significance of the factors of subjective norms and of PBC adds to previously mixed results (Cook, et al., 2002; Saba and Vasallo, 2002; Sparks and Shepherd, 2002; Sparks, et al., 1995). This is the first study to have examined general intentions towards GM food in Britain, however, and it is possible that previous negative results may have been due to specifics in the contexts used.

Attitudes and subjective norms positively predicted intentions so increases in these factors indicate that positive increases in intentions will occur and PBC negatively predicted intentions indicating that as PBC increases, the likelihood of intending to try GM food will decrease. This has interesting ramifications with regards to the current debate over the labelling of GM food. Labelling GM food increases an individual's control over their behaviour towards GM food which will also increase their PBC. Labelling GM food is, therefore, likely to decrease intentions to try GM food.

When the TPB was extended to include the additional predictors of self-identity, moral norms and emotional involvement, the amount of variance in intentions accounted for increased significantly to around 66%. Here emotional involvement and self-identity accounted for significant proportions of variance in intentions, along with

attitudes and PBC. The importance of self-identity in predicting behaviour towards GM food supports findings from previous studies, all which found self-identity to be a valuable construct in at least some of the intentions examined (Cook, et al., 2002; Sparks, et al., 1995). This was the first ever study to examine the construct of emotional involvement within the TPB and results showed that it was a useful factor with which to predict behavioural intentions towards GM food; it is recommended that this concept be examined in other future TPB studies and in future examinations of perceptions of GM foods.

All of the additional factors had positive influences on intentions indicating that as levels of these factors increase, so would intentions to try GM food. Moral norms did not predict intentions which adds to previously mixed results (Saba and Vasallo, 2002; Sparks and Shepherd, 2002; Sparks, et al., 1995) and indicates that this factor may only be a useful predictor in particular contexts or within particular populations in which morality plays a larger role, e.g. religious groups and environmental groups. In addition, subjective norms dropped out of the model as a predictor of intentions when the additional components are added. This may have been due to some collinearity between subjective norms and the new components added and future research should examine possible collinearities between predictor constructs utilised within the TPB.

Intentions were also found to positively, and significantly, predict behaviour both when this was characterised as the difference in amounts of money participants were willing to accept in preference to GM chocolates in comparison to non-GM chocolates and when this was characterised as whether participants were prepared to accept GM food over any amount of money. This means that as behavioural intentions to try GM food increase, approach behaviour towards GM food is more likely.

4.3. Levels of individual TPB model components

Results suggest that overall attitudes of those in our sample are fairly neutral towards GM foods and this is in line with Eurobarometer studies that indicate that explicit measures of attitudes in the British population generally find people to be ambivalent towards GM foods (Gaskell et al., 2003). In addition, levels of self-identity were neutral indicating that participants did not identify themselves, particularly, as people who would try GM food or who would avoid GM food. Contrary to our predictions, levels of subjective norms were significantly positive towards GM foods demonstrating that participants felt that their close friends and family would not object to them eating GM foods. Similarly moral norms were found to be significantly positive, suggesting that participants felt no moral obligation to avoid eating GM foods. This suggests that the negative results found by previous examinations of attitudes and intentions towards GM foods are unlikely to be attributable to wider social considerations, which contradicts previous research (Magnusson and Hursti, 2002; Shepherd, 1999). The difference in findings may be due to differences in study methods, in particular, the topic blind recruiting procedure which ensured that individuals who were particularly interested and engaged with the issue of GM foods did not self select themselves for the study. In fact, levels of emotional involvement within this study were found to be significantly negative, suggesting that participants felt significantly uninvolved in the topic and are not concerned about GM. Again, this contrasts with past studies reporting high levels of hostility toward GM (Grant et. al., 2003).

Participants' levels of PBC were neutral, so people did not appear to feel either, particularly in control, or not in control over their choice in eating GM foods. This differs from previous research that finds GM foods to be rated as a relatively

controllable concern (Townsend et al., 2004). However, Townsend et al., (2004) examined controllability quite generally, rather than personal controllability, and also presented GM food in the context of other issues, which may explain differences in findings between these studies.

For our participants, the overall intention to try GM food was marginally positive. This contrasts with the behavioural measure employed here that was defined as the monetary amount participants were willing to accept in preference to GM food subtracted from the monetary amount participants were willing to accept in preference to non-GM food. Intentions were in line with the other behavioural measure employed though that was defined as whether participants were willing to accept GM food at some cost. This makes intuitive sense as intentions were measured as a willingness to try GM food in a similar way to the latter behavioural measure, whereas, the former behavioural measure examined the value of GM foods in comparison to non-GM foods.

4.4. Generalisability of findings

It is acknowledged that the sample examined here was not truly representative of the British population. To this end, it would be beneficial for future research to examine a stratified sample of the British population in the same way, in order to draw reliable conclusions as to valuations of GM foods. But of critical importance to the reliability of our results was the fact that a community-based sample was used, which was recruited topic blind. Crucially this means that the results of this study were unlikely to have been influenced by self-selection biases that have plagued prior research on GM and will, therefore, give a good indication as to behaviour towards GM food. It is noted, however, the recruitment of naïve respondents for this survey may have also led to responses that were not very well thought out. In fact, the simple act of

completing this survey may have provoked further thought, and perhaps discussion, about GM food which may stimulate a change in potential future responses.

We also acknowledge that our results are limited by the situation in which they are examined. The generalisability of behavioural results found within this study is limited to purchase situations involving GM food; it is likely that behaviour towards GM food in different situations may differ (for example, if encountered at a dinner party). Further to this, it is possible that differences may be found between different food products. Chocolate may be considered a luxury good and it is quite possible that people may respond differently to GM versions of more basic food products. It is noted though that previous research has shown that a majority of participants would accept GM cheese (Lahteenmaki, et al., 2001) and a GM apple (Townsend and Campbell, 2004) indicating that results may be similar with regards to other food products.

4.5. Future Research

Participants within this study exhibited mainly neutral or positive perceptions of GM food. An interesting point made by an anonymous reviewer was that this may either be due to either a lack of knowledge about GM or indeed a great deal of considered knowledge about GM. Due to the low emotional involvement with the topic of GM noted within the participants within this study it is likely that the sample observed here had low knowledge about GM, however, this is an interesting point for future research. It would have been useful to have measured knowledge as a separate factor alongside the other constructs here to examine the impact that this might have on behaviour.

Results within this study found that behaviour within a British sample was much more positive than their attitudes indicated and this supports previous research by

Noussair et. al., (2004) in France. It is likely that a similar disparity between attitudes and behaviour towards GM food will exist within other countries and future research should examine this possibility. Although attitude surveys indicate that the majority of European countries are negative or ambivalent towards GM food, actual consumer behaviour towards GM food is likely to be more positive than this and GM food may be widely accepted if introduced.

Although our model fitted data well, the variance in behaviour accounted for in our models remains fairly low; some may be attributed to error variance; however, it is likely that further portions of variance may be explained by further factors that were not examined here. Constructs such as the perceived benefits of GM food or the individuals' trust of policy makers and industry may help to explain additional variance in intentions and behaviour (Siegrist, 2000; Poortinga and Pigeon, 2004).

In addition, behaviour is likely to consist of both deliberative and spontaneous processes. Only deliberative processes are examined by explicit questions, such as those asked during this study, hence, it is possible that spontaneous processes account for some of the variance in behaviour unaccounted for in the present study. Indeed, research has demonstrated that spontaneous processes are better predictors of actual behaviour than deliberative processes in some circumstances (Dovidio, Gaertner and Kawakami, 2002). Spontaneous processes can be measured using such tools as reaction time tasks, e.g. the IAT (Implicit Association Task; Greenwald, McGhee and Schwartz, 1998), and results from tasks of this type have proved useful in predicting behaviour (Fazio and Olson, 2003). Future research into choices relating to GM food utilises a combination of tasks that evaluate deliberative processes and tasks that evaluate spontaneous processes in predicting behaviour.

5. CONCLUSIONS

In conclusion, we found that most participants would choose GM food over some amount of money. GM food was found to be valued significantly less than non-GM food, though the majority of our sample was indifferent between GM and non-GM options. Results from this experiment indicated that a higher proportion of individuals were prepared to accept GM foods than some previous studies have indicated.

Differences can be attributed to the fact that, a) in the present study a private, rather than a public, decision was made with regards to GM food (using an equivalent gain task to avoid loss aversion effects), and b) this study used a real choice situation, rather than hypothetical questions. Hence, this method of measuring valuations may be considered to have yielded more realistic responses than previous measures. With regard to important behavioural influences, we found that attitudes, subjective norms, PBC, self-identity and emotional involvement were all significant determinants of behavioural intention and behavioural intention was a significant predictor of actual behaviour.

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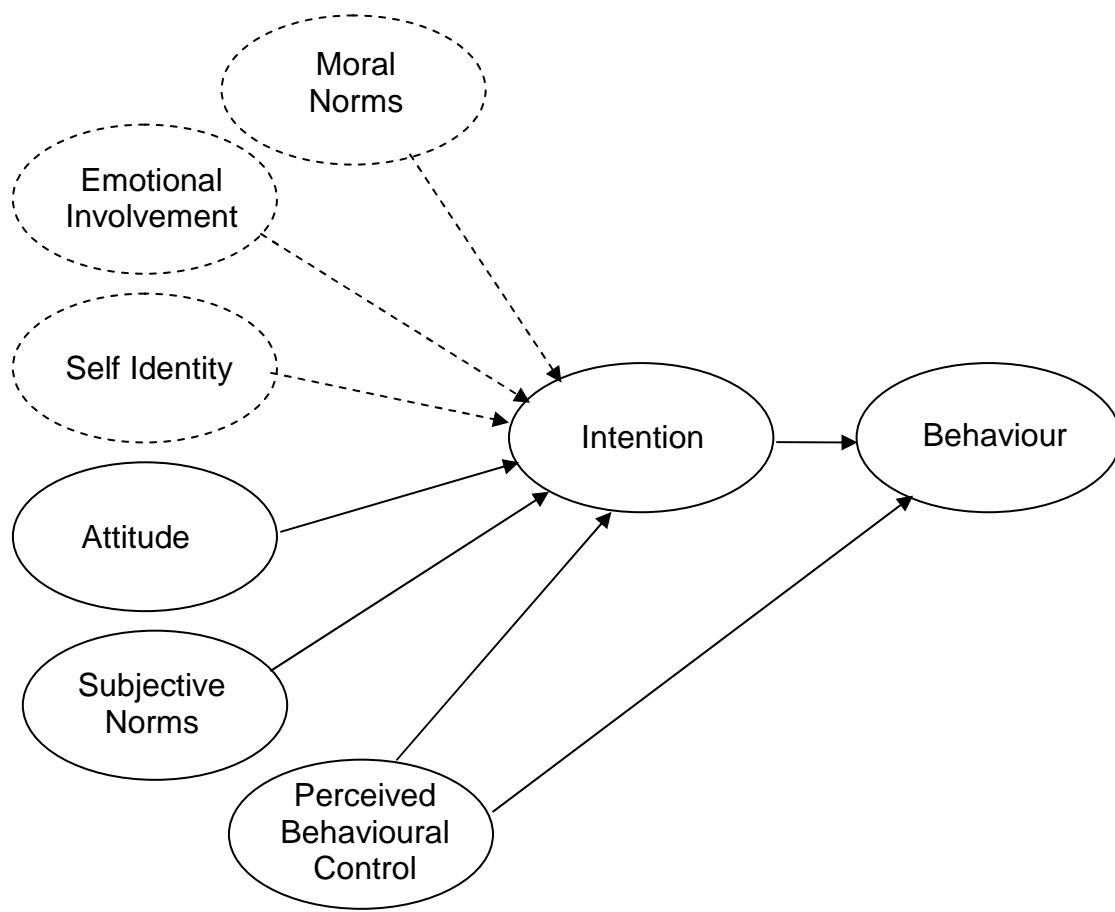
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APPENDIX

Construct	Items	Scale
Subjective norms	<ul style="list-style-type: none"> • “The people in my life whose opinions I value would not mind if the food they eat was GM.” • “Most people who are important to me consider GM food to be:” • “The people in my life who are important to me would not mind if I ate GM food.” 	<ul style="list-style-type: none"> • “True - False” • “Pleasant - Unpleasant” • “Agree - Disagree”
PBC	<ul style="list-style-type: none"> • “How confident are you that it is possible to avoid eating GM food?” • “Do you consider yourself able to monitor your diet and avoid GM foods?” • “How much control do you feel you have over eating a GM free diet?” 	<ul style="list-style-type: none"> • “Very confident - Not very confident” • “Not at all able - Very able” • “Complete control - No control”
Attitude	<ul style="list-style-type: none"> • “In general I believe that the use of gene technology in food production is:” 	<ul style="list-style-type: none"> • “Good - Bad” • “Positive - Negative” • “Safe - Dangerous” • “Beneficial - Harmful” • “Right - Wrong” • “Wise - Foolish”
Self-identity	<ul style="list-style-type: none"> • “I am the type of person that would eat GM food.” 	<ul style="list-style-type: none"> • “True - False”

	<ul style="list-style-type: none"> • “I am the kind of person who will only eat food that has been grown naturally without genetic modification.” 	<ul style="list-style-type: none"> • “True - False”
Moral norms	<ul style="list-style-type: none"> • “I shouldn’t really eat GM foods for moral reasons.” • “Morally, I have no problem with GM food stuffs.” • “I do not consider the production of GM foods morally wrong.” 	<ul style="list-style-type: none"> • “Strongly agree - Strongly disagree” • “Agree - Disagree” • “Agree - Disagree”
Emotional involvement	<ul style="list-style-type: none"> • “Do you feel that decisions about GM food are largely irrelevant to you?” • “Might decisions taken by governing bodies about the future of GM foods upset you?” • “To what extent do you feel like you’re emotionally involved in whether GM food should be produced or not?” • “How emotional do you feel about the decisions taken to produce GM food?” 	<ul style="list-style-type: none"> • “Definitely - Definitely not” • “Not at all - Very much” • “Very much - Not at all” • “Not very emotional - Emotional”
Intention	<ul style="list-style-type: none"> • “When eating, I intend to make sure that my food does not contain GM ingredients.” • “I intend to eat GM food at some time.” 	<ul style="list-style-type: none"> • “True - False” • “True - False”

Figure 1: The Theory of Planned Behaviour (Ajzen, 1988)



N.B. Original TPB components are illustrated with solid lines and components that have been added to the TPB are illustrated with dashed lines.

Figure 2 – Percentage of participants prepared to accept more, equal or less amounts of money instead of GM chocolates compared with that accepted instead of non-GM foods

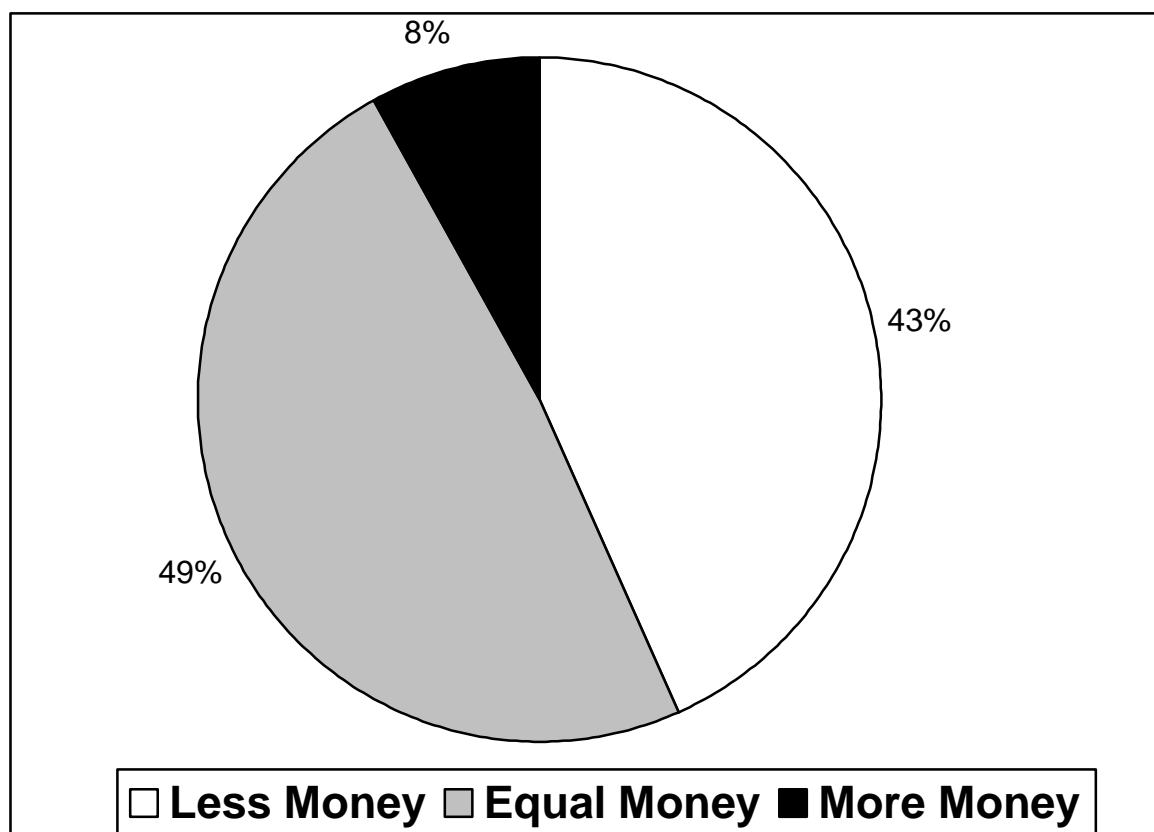


Table 1 – Mean response levels of factors examined

Factor	Mean level	Standard deviation
Attitude	3.84	1.34
Subjective norms	4.39*	1.21
PBC	3.77	1.37
Emotional Involvement	3.28*	1.41
Self Identity	4.38	1.65
Moral Norms	4.48*	1.40
Intention	4.39	1.45

* Significant at Bonferroni corrected level of significance, 0.00625 (0.05/8).

** Scales were continuous 7 point Likert scales where 1 indicates negativity towards GM, 7 indicates favour towards GM and 4 is neutral (For all variables apart from PBC and Emotional Involvement for which 1 indicates a low level and 7 a high level).

Table 2 – Correlations between factors (Pearson's r)

	Attitude	Subjective Norms	PBC	Moral Norms	Emotional Involve- ment	Self Identity
Attitude	-					
Subjective Norms	0.535**	-				
PBC	-0.117	-0.168	-			
Moral Norms	0.620**	0.472**	-0.205*	-		
Emotional Involve- ment	0.525**	0.479**	-0.061	0.511**	-	
Self Identity	0.636**	0.541**	-0.209*	0.551**	0.565**	-
Intention	0.666**	0.525**	-0.267**	0.574**	0.606**	0.740**

*Note: * $p < 0.05$, ** $p < 0.01$.*

Table 3 – Linear regression of predictors on intention

Predictor		Original TPB	VIF (TPB)	Extended TPB	VIF (Extended TPB)
Attitude	β	0.533	1.403	0.234	2.180
	t	6.278**		2.613**	
Subjective norms	β	0.211	1.424	0.039	1.633
	t	2.466*		0.497	
PBC	β	-0.169	1.030	-0.125	1.081
	t	-2.328*		-1.983*	
Moral norms	β			0.065	1.876
	t			0.783	
Self-identity	β			0.393	1.712
	t			4.449**	
Emotional involvement	β			0.202	2.119
	t			2.539*	
R		0.715		0.813	
R Square		0.511		0.661	
F Change		33.141**		13.471**	

*Note: * $p < 0.05$, ** $p < 0.01$.*

Table 4 – Linear regression of intention and PBC on behaviour[†]

Predictor	Behaviour	
PBC	β	-0.032
	t	-0.341
Intentions	β	0.436
	t	4.598***
R	0.446	
R square	0.199	
F Change	11.896***	

*Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

[†] *When defined as difference in amounts of money accepted over GM or non-GM food*

Table 5 – Logistic regression of intention and PBC on behaviour[†]

Predictor	Behaviour	
PBC	B	0.018
	Wald	0.005
	Exp(B)	1.018
Intentions	B	0.996
	Wald	12.074***
	Exp(B)	2.707
Cases classified correctly	74.7%	
McFaddens pseudo R ²	0.137	
Chi-square	16.144***	

*Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

[†] *When defined as whether the participant would accept GM food over some amount of money.*

¹ Any food containing ingredients containing more than 0.9% genetically modified organisms must be labelled.

² Willingness to pay estimates may include a loss aversion to money effect, whereas willingness to accept estimates may include a loss aversion to goods effect.